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Radiocarbon as a tracer for climate change studies

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Radiocarbon analyzed in isotopic archives such as tree rings and marine sediments have been used for tracing past as well as recent climate changes caused by Sun-Earth orbital parameters, solar activity cycles and by increases of green-house gases in the atmosphere. The most visible past climate cycles were represented by Milankovitch cycles, as documented by observed O-18 and Be-10 variations in ice cores sampled in Antarctica and Greenland, where in the past 800 kyr the dominant cycle was due to the variations in the eccentricity of the Earth orbit (125 kyr period). The exceptional case was a warm period during the Holocene (last 11 kyr), where radiocarbon records during the last 50 kyr, as possible proxies of climate changes, have been recently investigated. The climate changes during the Holocene were most probably due to orbital variations, which changed the latitudinal and seasonal distribution of solar radiation on the Earth. Although the Holocene was generally a warm epoch, there were cool periods as well, such as a Little Ice Age (14th-19th century), which followed after the Medieval Warm Period (11th –middle of 14th century). The cool period coincided partly with the Maunder minimum, however, physical mechanisms explaining how changes in solar activity could affect Earth's climate require further investigations. Remarkable increases in surface temperature have been observed during the last century, which could be associated with increases of green-house gases in the atmosphere (mainly CO2 and CH4), having also impacts on sea ice cover changes, on sea level rise, etc. Future trends in climate change remain, however, a great challenge for better understanding of anthropogenic and natural processes which could affect Earth's climate (e.g. solar activity impacts via secondary effects). High-quality radionuclide data (mainly radiocarbon in tree rings and Be-10 in ice cores) will be useful source of information on past climate changes.

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